Situated Cognition and Knowledge: a Contribution Towards Conceptual Clarity for Knowledge Management

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Abstract

Knowledge management has emerged as a growing field of practice and research but the concept of knowledge itself remains vague. This is an unsatisfactory situation that may well hinder the development of knowledge management theory and practice. In this paper Alexander et. al.'s (1991) educational knowledge framework is combined with Clancey's (1997a) work on situated cognition to provide a clear framework for knowledge management. This provides us with the critical distinction between knowledge as situationally dependent and enacted human capacity, and knowledge representations. 'Knowledge' can thus only be managed indirectly, through managing human talent, a process that should be integrated with the management of knowledge representations.

1. Introduction

The idea that 'knowledge' is economically important has been discussed, if only sporadically, since at least 1945, [Hayek 45; Boulding 66] and received growing attention from the 1960s [Lamberton 71]. The idea that it could and should be 'managed', however, seems not to have been seriously considered until a decade or so later. Since the mid-1990s, 'knowledge management' has emerged as a rapidly growing field of management activity, enquiry, writing and research [Scarborough et.al. 99; Hedlund 94; Nonaka and Takeuchi 95; Drucker 93], and has been described as involving a «paradigm shift» in business management [Nonaka 94, Nonaka et.al. 96].

Contemporary interest in knowledge management is due to a number of developments including difficulties experienced in the aftermath of 1980s downsizing activities; maturation of ideas relating to information management; growing competitive pressures leading organizations to look more to the market, and to customer service relations; and the emergence of the resource-based perspective on business strategy [Covin & Stivers 97]. The field has been dominated by writers and practitioners from the information systems and related disciplines [Scarborough et.al. 99] although the critical

significance of the human dimension, and allied management techniques has increasingly been recognized [e.g. Davenport et.al. 98; van der Spek and Spijkervet 97; von Krogh 98; Snowden 97].

One characteristic of the field of knowledge management is that little attention has been paid to what would appear to be a central concept - 'knowledge'. While disciplines such as education that also require an operational definition of knowledge also appear to have neglected this issue [Alexander et.al. 91] I believe it is both necessary and useful to attend to this issue. The phrase 'knowledge management' implies, like 'operations management', or 'human resource management' a particular focus of management activities. Yet if managers do not have a clear idea about what 'knowledge' is, we cannot evaluate knowledge management practices, understand the effects of actions taken in the name of knowledge management, assess the relationship of knowledge management to other management activities, or evaluate the claim that knowledge management is just another fad of consultants and academics.

In this paper I will outline some perspectives on knowledge drawn from education, and from situated cognition. References to epistemology, the traditional arena for discussing 'knowledge' will be minimal as by and large epistemologists appear not to have been concerned with operationalizable definitions, but with wider concerns which can safely be left to one side for the present.

2. Knowledge Management and Knowledge

Hedlund (1994) pointed out that it is not clear precisely what 'knowledge management' means. A review of knowledge management and organizational learning literature suggested 'knowledge management' is a multi-faceted, multi-layered concept definable as: «any process or practice of creating, acquiring, capturing, sharing and using knowledge ... to enhance learning and performance in organizations.» [Scarborough et. al. 99]. Lank (1997) suggested that knowledge management involves «collecting, connecting, creating and applying knowledge for short term and long term sustainability». Mackintosh et.al. (1999) claim that knowledge management is concerned with managing both «knowledge assets» («knowledge regarding markets, products, technologies and organizations») and the processes that act upon those assets. Lank (1997) also suggested that knowledge management entailed facilitating connections between people, arguing that effective knowledge management ensures people with needs can find people who know within an organization. Myers on the other hand emphasised the capture and storage of knowledge in organizations' systems, processes, products, rules, and culture [Myers 96].

The delineation of the field of knowledge management is likely to rest on how the word 'knowledge' is defined both implicitly and explicitly. Some authors have suggested that it is not productive to attempt to define knowledge [Snowden 97], or that it is of little use to practitioners to engage in conceptual analysis [Davenport et.al. 98]. Others have, however, attempted define knowledge, and have largely done so in terms of 'information'. Hedlund, for example, acknowledged that 'knowledge' and 'information' should be distinguished but he used them interchangeably [Hedlund 94]. Myers (1996) called organizational knowledge «processed information», while Davenport and his colleagues (1998) defined knowledge as «information combined with experience, context, interpretation and reflection. ... a high-value form of information ...». Nonaka and his colleagues describe knowledge as «a meaningful set of information that constitutes a justified true belief and/or an embodied technical skill» [Nonaka et.al. 96].

Equating knowledge with information does not get us very far. Nothing is said in these accounts about how 'processing' or 'combination' transforms 'information' into 'knowledge', or how information acquires 'meaning' or becomes 'constituted' as a belief. Instead we find that one abstract concept, knowledge, is defined in terms of another equally abstract concept, 'information', and since this is left undefined a common-sense understanding is implicitly assumed. This, however, will not do: Stamper

(1996) has shown that information is a vague and elusive concept susceptible of being understood in a variety of ways. The philosophers' definition of knowledge as «justified true belief» [cited in Nonaka and Takeuchi 95; see also Nonaka et.al. 96] was apparently criticized in ancient times on the grounds that it raises the question of how the justifiers themselves can be justified [Brown 94]. Besides, philosophers may have departed from this view, preferring to define knowledge as «true, warranted belief»; justification is insufficient as something can be justified even if it rests on false premises [Klein 98].

The situation as regards a definition of knowledge in the field of knowledge management is thus clearly very unsatisfactory. Yet this has not hindered the extraordinary proliferation of apparently different kinds of 'knowledge'. Tacit knowledge and explicit knowledge [e.g. Nonaka & Takeuchi 95] are widely used. In addition we find terms like know-how, know-what, know-why [e.g. Whitehill 97; Quinn et.al. 96; Bonaventura 97]. Other typologies include symbol-type; embodied, embrained, encultured, and formal [Collins 93] and Teece (2001) refers to codified, tacit, organizational and, personal knowledge, and to knowledge embodied or embedded in «technology» [see also Blackler 93, 95]. These typologies are all largely lists - they lack the discussion of categories and definitional principles that should accompany the development of a serious typology. Moreover, generally little or no evidence is offered to substantiate the claim to a knowledge-type other than an illustration to indicate what the creator of the term wants to indicate. We also find different uses being made of the same term. Collins (1993) refers to tacit knowledge as «located in society» whilst for Nonaka and Takeuchi (1995) it is personal and private. Above all there is no attempt to show how these alleged types are actually connected with each other: in other words, how 'knowledge' is actually being defined.

Perhaps this confusion is inevitable. Alexander et. al. (1991) note the view that terminological precision and delimitation only happen when some kind of major breakthrough occurs, and that as long as authors are consistent in themselves, a unified terminology is not necessary. On the other hand failure to establish a coherent terminological framework hinders communication, which can have further practical consequences [Alexander et. al. 91]. Knowledge management is still young, and has not reached any major point of breakthrough but a deeper source of the confusion probably lies with the subject-matter itself. Dewey and Bentley argued that «knowledge» is a «loose name», one of those ««vague words» one is at times compelled to use» because it has been used to refer to a great many often different things [Dewey & Bentley 49]. Bentley noted that «Whenever men apply the word, [«knowledge»] living organisms are involved also.» [Ratner & Altman 64] but Teece (2001) among others writes of 'knowledge' being 'in' technology! The present confusion in education, and knowledge management, would seem to confirm Dewey and Bentley's judgement of half a century ago.

I do not propose to resolve a problem that has occupied many great minds over the centuries, but simply to describe some recent discussion of 'knowledge' from outside the field of knowledge management in the hope that this will facilitate discussion and practice within that field. I shall also follow Dewey and Bentley (1949) in using 'knowledge' in a loose way throughout much of this discussion.

3. Perspectives on Knowledge

Knowledge management shares with education and artificial intelligence the need for a practical working definition or conceptualization of 'knowledge'. Alexander et. al. (1991) and Case (1996) have discussed the issue from the perspective of education while Clancey in particular (e.g. 1997a) has developed the idea of situated cognition from a base in artificial intelligence. We will begin with Case's (1996) account, then look at Alexander et. al.'s (1991) framework before outlining a situated

cognitive perspective on knowledge. The relationship of these to autopoietic and connectionist perspectives [von Krogh et. al. 96; Sierhuis & Clancey 97; Venzin, et. al. 98] will be noted in the conclusion.

3.1 Empiricism and Rationalism

Case (1996) suggested there are three important traditions regarding 'knowledge': the empiricist, the rationalist, and cultural or socio-historic perspectives. Here we will deal briefly with the empiricist and rationalist perspectives; the cultural or socio-historical perspective is closely allied to situated cognition, and will be discussed separately.

Empiricism assumes there is an external world which we perceive through stimuli affecting our senses [Case 96]. We detect patterns in those stimuli, which are subsequently stored in memory as knowledge. The external stimuli are thus the source of all knowledge which is consequently universal, and objective. Treating individuals as metaphors for organizations, this approach is applied to organizations which are thus said to process and transform information obtained from outside, derive knowledge as a result of processing this information, and store it in organization-wide knowledge structures [Aadne et. al. 96; see also von Krogh et.al. 96]. Knowledge can thus be defined as «a repertoire of patterns that we have learned to detect and operations that we can execute on these patterns» [Case 96].

The rationalist approach, on the other hand, allocates a central role to individuals' minds in the construction of knowledge [Case 96]. From this perspective, the senses provide data to the mind, that in turn imposes order on what is perceived: in place of mind as pattern detector we have mind as pattern creator. Knowledge is thus seen as originating primarily in the person's actions in and on the world, and therefore as located in individual cognitive processes [Case 96]. A definition of knowledge consistent with this perspective is that it is «something that is constructed by the mind, and evaluated according to rational criteria ...» [Case 96].

It would seem there is little to choose between empiricism and rationalism for knowledge management purposes. Both are primarily concerned with the ultimate origins and nature of knowledge, issues that are of marginal interest to knowledge management. In so far as knowledge managers are concerned with knowledge creation, both empiricism and rationalism appear to attribute this to individuals interacting with their environment. Managing the process of person-to-environment relations effectively is thus suggested by both viewpoints: the difference is that empiricism stresses the determining role of the environment; rationalism, that of the individual. As we will see, this idea is incorporated in the situated perspective.

3.2 Knowledge in Learning and Literacy

Alexander et. al. (1991) noted while the construct of 'knowledge' was exceedingly important in cognition and learning, there were some difficulties arising from terminological imprecision. They reviewed uses of knowledge-related terms focusing on literature on cognition and literacy on the basis of which they constructed a conceptual framework, and developed some definitions. In this section I will outline and comment on their framework, drawing in some of the definitions. Their framework was not explicitly connected with situated cognition but I will argue that it is compatible with that approach, and offers additional dimensions that are useful in this context.

They defined 'knowledge' broadly to cover all that someone knows or believes to be true, regardless of whether verified or not [Alexander et. al 91]. They also assume that all forms of knowledge are "fluid and dynamic", meaning that forms vary between and within individuals. Further, forms of knowledge are interactive, meaning one form can influence another [Alexander et. al 91]. Against this background they proposed a framework (Figure 1) within which we can view individuals as having "prior

knowledge" which is critical in any situation. «Prior knowledge» is a term synonymous with background, experiential, and pre-existing knowledge among other terms [Alexander et. al 91] and takes two forms: tacit knowledge and explicit knowledge.

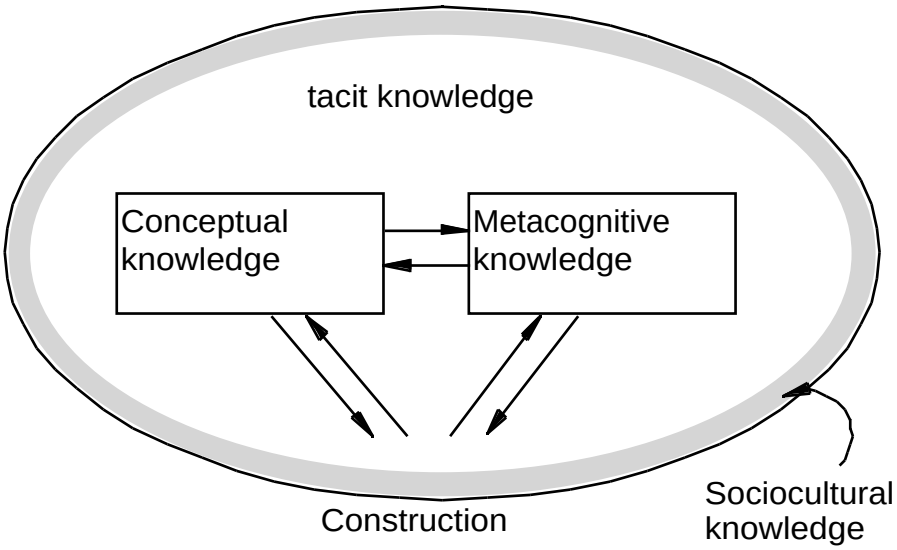

Figure 1 - Prior knowledge [Alexander et. al. 91]

Tacit knowledge is simply knowledge of which we are normally or currently not aware [Alexander et. al 91]. It is divisible into two aspects - "sociocultural knowledge" and the rest. Sociocultural knowledge is so to speak a filter through which all experiences pass, specifically here the beliefs of the person's group, culture and so on [Alexander et. al 91]. They do not specify additional dimensions of tacit knowledge simply implying an 'other' tacit knowledge covering all other fields and aspects of knowledge other than the sociocultural. This tacit knowledge base is, they claim, largely unrealized and unanalyzed, but parts of it can always come into consciousness, and thus be studied, although it may also be that some parts of tacit knowledge never reach explicitness [Alexander et. al 91]

Explicit knowledge is "knowledge that is directly guiding on-going interaction with the world; analyzed knowledge" [Alexander et. al 91]. In other words, explicit knowledge is that part of tacit knowledge which is currently activated by some on-going situation in which the individual is partaking. Explicit knowledge is also divided into two aspects: knowledge of concepts and ideas («conceptual knowledge»), and knowledge about knowledge («metacognitive knowledge») [Alexander et. al 91]. Both types are further subdivided but the details need not concern us here. Implicitly the 'container' of tacit knowledge in all forms, as well as both forms of explicit knowledge, is the brain or 'mind' of an individual.

Alexander et. al. (1991) complete their framework by proposing a 'mechanism' for linking the individual's knowledge base with the external world. This 'knowledge interface' or "bridge between prior knowledge and external conditions" they call «construction» [Alexander et. al 91]. The dimensions and functioning of this 'bridge' are only sketched, but it appears they intend to suggest that it is through the 'interface' with the external world that aspects of the individuals knowledge-base (tacit knowledge) are made explicit. Thus they state that "conceptual knowledge … is built from the activation and utilization of the individual's prior knowledge…" [Alexander et. al 91]. As a result the individual's "system of knowledge … is continually in a flux as a consequence of its confrontation with the world external to it" [Alexander et. al 91].

Alexander et. al.'s definition of knowledge could well be adopted by knowledge management writers since it is one most implicitly use - i.e. that 'knowledge' is simply 'what people know'. Their terms

tacit and explicit knowledge, however, differ significantly from the way they are used in knowledge management literature.

Their term 'tacit knowledge' partly mirrors that of knowledge management writers since they propose that some tacit knowledge may never become explicit or reach the level of consciousness. On the other hand, first they use tacit knowledge, in effect, as synonymous with 'knowledge' in the sense of what someone knows: their terms 'knowledge' and 'tacit knowledge' appear indistinguishable as regards the object to which they refer. Second, they make the distinction between sociocultural knowledge and 'other' tacit knowledge. On the whole, therefore, their term 'tacit knowledge' is richer and broader in scope than the identical knowledge management term although it could perhaps be argued that implicitly knowledge management writers also mean 'what someone knows' when they write 'tacit knowledge'.

Alexander et.al.'s version of explicit knowledge is quite different, though also not incompatible with, the familiar knowledge management term. For them, explicit knowledge is that portion of tacit knowledge currently active, and (implicitly) of which the individual is aware. It is therefore not necessarily separated from the knowing individual. In so far as the person is aware of this knowledge, and they can express some of it in words the can make it 'explicit' in the more usual sense of the term. Since this implies that some explicit knowledge (in Alexander et.al.'s sense) might be impossible to express in words, this must remain tacit (in the more restricted but familiar sense of this term). Their 'explicit knowledge' thus consists of both explicit and tacit knowledge in the usual but more limited senses of those terms.

3.3 Situated Cognition and Cultural or Socio-Historical Perspectives

Cultural or socio-historical perspectives on knowledge were identified by Case as a third tradition originating in the cultural-historical school of psychology of which Vygotsky was a founding figure [Case 96]. This perspective is also known as activity theory [Engeström and Miettinen 99] and emphasizes a historical, object-oriented and collective approach to human activity and knowledge [Engeström and Miettinen 99; see also Blackler 93; Engeström et.al. 90, 99; Engeström 93]. Activity theory shares many key assumptions with situated cognition, as well as with pragmatic philosophy, symbolic interactionism, situated learning, and theories of mediated action [Engeström and Miettinen 99; Star 96; Lave and Wenger 91; Clancey 97a; Sierhuis and Clancey 97; Wertsch 98]. Because of this, and because situated cognitive perspectives on knowledge/knowing appear more fully developed than those of activity theory, discussion of the cultural or sociocultural approach will be subsumed within that of situated cognition.

Situated cognition is part of the emerging «situative perspective» on human behaviour, learning, development, cognition, and psychology [Greeno et.al. 98; Putnam & Borko 00]. 'Situated cognition' is something of a misnomer since its proponents argue that *all* cognition is situated. For the present, however, we have to use this term to distinguish it from mainstream cognitive science. Conceptualization of knowledge and knowing within the context of situated cognition owes much to Clancey's discussion of problems arising from the representationist legacy in artificial intelligence [e.g. Clancey 95, 97a, 97b]. His argument is a complex one, ranging as it does from artificial intelligence and cognitive science to ecological psychology, models of brain functioning, and the sociology of knowledge. He also emphasises the importance of 'activity', a key socio-historical concept, although he appears to use it in a less specific sense than the latter tradition.

Clancey defined knowledge as the «capacity to interact, to reflect, to innovate.» (1995); «to coordinate and sequence behavior» (1997b); the «capacity to engage in an activity» (1997b:). Ryle, whose debt he acknowledged [Clancey 95], similarly argued that: «'Know' is a capacity verb... of that special sort that is used for signifying that the person described can bring things off, or get things right. ...» [Ryle

49/63]. The suggestion to view 'knowledge' as a capacity was contrasted with the more traditional one of seeing it as some kind of «static «body»» [Clancey 97a]. This distinction is an important one. Typically to talk about 'knowledge' we employ metaphors that suggest it is a 'thing' that people have, that can be stored, and transferred in 'containers', and so on [Reddy 79]. 'Capacity' could be understood still as referring to a 'thing' but whether it can be meaningfully understood *as capacity* if considered apart from 'being possessed' is questionable. Assuming A is a capacity of B, if it is separated from B, then it ceases to be a capacity of B, and becomes something else: it is only a capacity when integral to B. Considering 'knowledge' to be indicative of some relationship between a knower and a known then this indicates we should consider 'knowledge' to exist only in the context of a knower-known relationship (or transaction) [Dewey and Bentley 49; Clancey 97a].

While some of the language used here implicitly relates to individuals it is important to recognize that situated cognition, in common with activity theory, regards the individual:society relationship as complementary, not oppositional. Rosenblatt, writing from an altogether different disciplinary context, suggested we can view language as «at once basically social and intensely individual» [Rosenblatt 94], a notion compatible with both activity theory and situated cognition. From an activity theory perspective Toulmin suggested that knowledge can be described as the established procedures of any professional discipline, «*at a given time*» [Toulmin 99, original emphasis]. While Toulmin confined his comments to «professional work», there seems no reason not to extend his definition to any and all kinds of human activity. Knowledge is something subject to verification by procedures accepted by social groups («communities of practice» - Lave and Wenger 91; see also Kuhn 70), and not just an attribute of individuals. These knowledge procedures are always the property of groups or collectivities of people as they are developed through interaction and dialogue between individuals, in the context of activities such as work.

Clancey suggests that a more appropriate metaphor for knowledge, as befitting a capacity, is of «energy» [Clancey 95; 97b]. Maxwell, whose work on electricity paved the way for the twentieth century revolutions in physics, wrote that his work showed that «the energy of a material system is conceived as determined by the configuration and motion of that system» [Maxwell 1877, quoted in Dewey and Bentley 49]. This clearly fits well with the idea that knowledge is «*dynamically constructed* as we conceive of what is happening to us, speak, and move» [Clancey 97b]; and that knowing occurs in the process of acting [Sierhuis & Clancey 97]. Further, Clancey suggests that «knowledge» «corresponds to conceptualizing and other representing processes in the brain» [Clancey 97b] and is simultaneously «inherently «neural» in form» (as a process in the brain), and simultaneously «inherently social in content» because it develops with respect to activities, which are themselves socially constructed [Clancey 97b]. Cognition can in fact be understood as 'situated' in three analytical senses: functional or social, structural or interactive, and behavioural or psychological [Clancey 97a; Clancey et.al. 98].

Changing the order here to functional, behavioural, and structural highlights the implicit temporal dimension underlying the three categories in a way that clarifies their interrelationships. The functional or social perspective emphasises the social grounding to how people interpret what they are doing, their intentional stance, and how that can be understood to arise and be shaped. An individual's «knowledge is *functionally situated* as that of a person who participates in our society in a certain way»; «knowledge of activities ... is with respect to social relationships and purposes» [Clancey 97a]. Kuhn's (1970) account of how novice scientists acquire the appropriate paradigms provides another. Kuhn argued that it is only by doing exercises that a student discovers how to see their problems as like those already encountered, and subsequently to view «the situations that confront him as a scientist in the same gestalt as other members of his specialists' group. ... they are no longer the same situations he had encountered when his training began. He has meanwhile assimilated a time-tested and group-licensed way of seeing.» [Kuhn 70]. Studies of negotiated order [e.g. Strauss et. al. 63] and

recent ethnographies of work [e.g. Orr 90, 96] also illustrate how the process of collective formation of working procedures is developed and sustained. From this perspective, situated cognition is a theory of conceptual content: «knowledge is inherently social in content» [Clancey 97b]. We might add that knowing also entails social processes - it is not simply that content is socially determined.

The second sense in which cognition is situated is a behavioural [Clancey 97a], or psychological one [Clancey et. al. 98]. Cognition is behaviourally situated in that in performing, «perception, movement, and conceptualization are changing with respect to each other moment-by-moment». [Clancey 97b]. It is «grounded» in everyday activity, «an interactive spatial-temporal setting» [Clancey 97a], a notion that emphasises «the local feedback and time-sensitive nature of action in place» [Clancey 97a] and behaviour as being «improvised by resequencing and recomposing previous behaviors» [Clancey et. al. 98]. The detail of behaviour is shaped by continuous reflection on and feedback from what has just been done. In this way, cognition is a process of continual readjustment of the next step in the light of what has just been accomplished: «action changes the person and the environment» [Clancey et.al. 98]. Knowledge is therefore also local, contextual, and continuously changing.

Clancey is somewhat ambiguous about the behavioural aspect since elsewhere he merges it with the social or functional perspective [Clancey 97a]. It does however appear to be a distinct and useful analytical category, not least as from a temporal perspective it lies 'between' the social and the structural forms of knowledge. Time in the functional sense of situated is implicitly 'long' relative to behavioural situatedness since behavioural processes always occur within social-functional contexts.

The link between these two situated aspects of cognition can be illustrated by a reflective account of craft blacksmithing, framed within activity theory [Keller and Keller 93]. This account describes how one of them, an amateur blacksmith, prepares for and begins to make something 'in the spirit' of a 19th century kitchen implement by examining historical examples and records; reviewing other information about the tools, previous making of similar tools, and information about materials, skills, and production constraints [Keller and Keller 93]. In this way «an umbrella plan, an internal representation of goal and procedure.» [Keller and Keller 93] could be formed which was subsequently modified in the course of the manufacturing process: «microorganizations of task conception and material conditions, are developed in the act of production ... . It is in these specific productive steps that reorganizations of knowledge and action take place» [Keller & Keller 93]. They concluded:

> One needs, therefore, to know enough directly or indirectly to conceptualize an orientation toward a goal: to provide a combinatorial arrangement of previous knowledge in the service of a new, and therefore partially unknown, production. Beyond this point ... what one needs to know to behave appropriately becomes a product of behaving. ... «All one needs to know» is only specifiable on the attainment of a goal ... . [Keller and Keller 93].

The cognitive processes involved in this activity were socially situated by the maker's concern to meet social expectations of the 1990s about the authenticity of 19th century replica tools. In order for the artefact to be 'in the spirit' of a genuine one, they used *relevant* sources of information to determine what it might look like, and so on. Further, manufacturing was behaviourally situated in that, as they put it, «what one needs to know ... becomes a product of behaving». Interaction with the implement-in-the-making, together with internal representing and conceptualization, shaped the next act on a «moment-by-moment basis».

The third, structural, dimension of situatedness concerns the «physical structure of knowledge» [Clancey et. al. 98]. It is largely a hypothesis about brain functioning and the manifestation of knowledge as capacity to act at that level for which he draws on Edelman's theory of neuronal group selection [Clancey 97a; Edelman & Tononi 95] and on ecological psychology [Clancey 97a]. This review leads him to develop a model of cognition in which «perception, conception, and action are

physically coordinated» [Clancey 97a]. Thus, for example, we perceive a two-dimensional drawing as three-dimensional because we perceive drawings as being about things in the world we have encountered: «human perception and meaning attribution arise together; they are coupled through experience and influence each other.» [Clancey 97a]. Cognition is situated, from this perspective, because conceptualizing is linked to sensori-motor coordination [Clancey 97a]. This aspect of cognition is linked to the other two through the 'mechanism' of conceptualization - «The conceptualization of a *social action* involves a kind of internal feedback that permits people to conceive *that they are conceiving ...*» [Clancey 97a]. From the temporal perspective this dimension is 'contained' within the behavioural one while at the same time it pervades and underlies all cognitive activity.

If 'knowledge' is a capacity, 'embodied' in conceptualization (a neural process) and in behaviour and social actions, what are we to make of books, computer file contents and other things we typically refer to when we speak of 'knowledge'? One of the strengths of Clancey's discussion of situated cognition is that it provides an perspective that also facilitates conceptual development of knowledge management. Clancey argued that those artefacts such as books, maps, instructions, goal statements, beliefs and so on, that we typically refer to as 'knowledge' are really *representations* of knowledge [Clancey 95]. (He might rather perhaps have said that some artefacts are themselves containers of knowledge representations.) The distinction between representations of knowledge, and knowledge not being equivalent or interchangeable, is crucial. As Clancey put it, figuratively speaking, knowledge representations lie 'between' performances – the past performance that is reflected on, and the future performance toward which end 'knowing' is directed , [Clancey 97b]. He indicated this relationship with the following diagram:

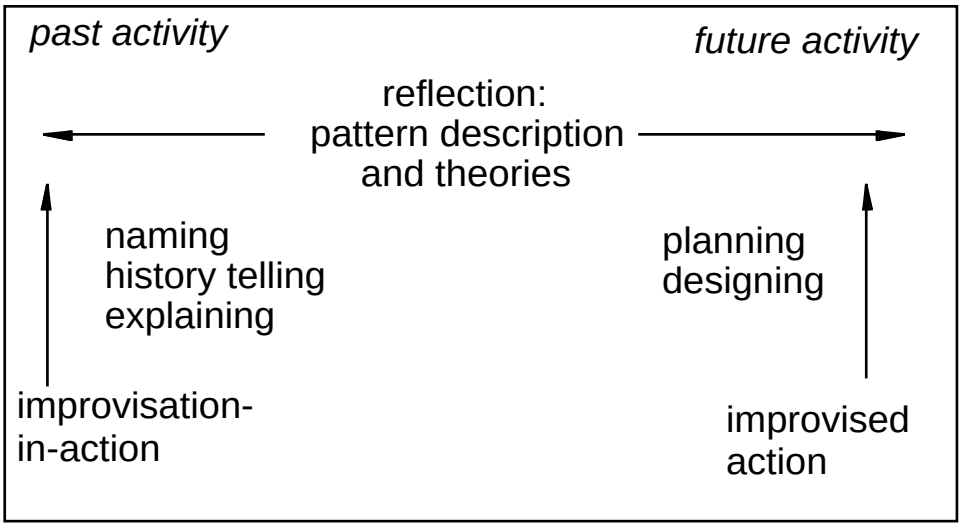

Figure 2: Descriptions lie between performances

[Source: © American Association for Artificial Intelligence. Reproduced with permission from Clancey, W. J. 1997b, Figure 2, p. 260]

In order for representations to bring into being a capacity on the part of a sentient being, to become knowledge, in the situated cognitive sense, they have to be re-conceptualized [Clancey 95]. Use of representations always involves interpretation and creativity, and interpretation is always contextual [Clancey 95; 97b; Gourlay 01]. Representations are thus tools for inquiry [Clancey 97b].

4. Towards an Integrated Framework

Alexander et. al.'s model is a dualist one. They posit a knowing individual, bearing «prior knowledge» in their head. By approaching the issue in this way they have then to pose and face the classic epistemological question of how what is 'in the head' can be 'connected' with what has been defined implicitly as 'the outside world'. For this they proposed the idea of 'construction', and site or set of processes that relate the individual to the world, and at the same time cause the selective transformation of tacit into explicit knowledge (in their sense of these terms). If we abandon the inherent dualism of their model, we can bring it into line with situated cognition, thereby providing a richer model overall.

The dualism of life-form *vs*. environment whereby life-form reacts to environmental stimuli is equivalent to the classic behaviourist stimulus (S) response (R) model, often depicted in the form S→R. The S→R perspective on the organism:environment relationship was criticized from as early as 1896 when Dewey argued that stimulus and response should be seen as mutually determining, not as sequential [Dewey 1896]. Similarly Piaget wrote that: «we should at least write $S \leftrightarrow R$, or $S \rightarrow (A) \rightarrow R$ (where *A* stands for assimilation into a schema)» [Piaget 71] instead of $S \rightarrow R$. From this perspective, the individual's 'prior knowledge' affects what becomes a stimulus, and thus what transforms prior (tacit) knowledge into explicit knowledge. Moreover, based on Piaget's notion of schema as formed through organism↔environment transactions [Piaget 71], and Edelman and Tononi's idea of neuronal structures [Edelman & Tononi 95], we can envisage that this organism↔environment transaction influences both the neuronal 'shape' and the social 'content' of tacit knowledge.

To illustrate, think of an individual who is not conscious, but asleep. We can regard that individual as having a reservoir of 'prior knowledge' that is largely inert. (Inert, that is, from the perspective of knowledge management as it is likely to be active in a special way, to do with physiological and other unconscious processes). As that person awakens, the quality of their transactions with their environment changes, and with this change explicit knowledge is formed as tacit knowledge is 'awakened' or perhaps better, is 'reconstituted' or 'reconstructed'. Tacit knowledge becomes explicit only through the actions of that individual in the world, and is also transformed by such transactions. Similarly, 'explicit knowledge' 'recedes' back to the tacit reservoir when it is no longer being activated. From this perspective, Clancey's 'knowledge' appears similar to Alexander et.al.'s explicit knowledge - it is that situated capacity of an agent. Alexander et. al.'s framework helps draw attention to what is retained from one situation to the next, and how it is retained - as tacit (implicitly neural) processes or structures that will both shape and be shaped by future organism↔environment transactions.

We are not concerned here with the wider implications of this framework, but with the issues of what this approach implies for managing knowledge, and in particular, what it implies about the role of the human agent and human talent in knowledge management. Before doing that it is useful to note two other perspectives that also appear to complement this 'situative' view of knowledge and knowing - autopoiesis, and connectionism

Von Krogh and his co-authors have outlined an «anti-representationist» theory of organizational knowledge based on autopoiesis [von Krogh et.al. 96; Venzin et.al. 98] a theory originally developed in neurobiology to explain the functioning of biological organisms [Capra 96; von Krogh et.al. 96]. At its heart is the notion of a closed, self-sustaining system of interacting components, such as a biological cell [Capra 96]. According to von Krogh and his colleagues, autopoietic theory suggests that «cognition is a creative act of bringing forth a world. Knowledge is a component of the autopoietic (self-productive) process ... [and] is not abstract but rather is embodied in the individual ...». Knowledge is something known by individuals, and is thus dependent on their viewpoints. Venzin et. al. (1998) suggested that from the autopoietic perspective, knowledge can be defined as something that «resides in the mind, body, and the social system. It is observer- and history-dependent, context-

sensitive ...». This clearly suggests some overlap between situated cognition, and autopoiesis, a view endorsed by Sierhuis and Clancey (1997).

Venzin et.al. (1998) have proposed the idea of a «connectionist epistemology», based on connectionist (neural network) computing. In this light they have suggested that organizational knowledge can be seen as «a state in a system of interconnected individuals», and knowledge as «dependent on the state of the network of interconnected components.» [Venzin et.al. 98]. Edelman (1992) believes that connectionist models are poor analogues of brain functioning, and it remains to be seen whether they are any better for organizations. The epistemological implications of connectionism are also unclear. While it adheres to key assumptions of representationism, particularly in seeing the environment as the prime source of knowledge [Venzin et.al. 98] it also undermines representationist models [Werner et.al. 93; van Gelder 96]. Some versions of connectionism appear compatible with analyses of mediated action [Wertsch 98], and distributed cognition [see e.g. Hutchins 93], two other perspectives which have strong affinities with 'situative' approaches.

5. Implications for Knowledge Management

Before turning to consider some of the implications of this framework we should remember that knowledge management processes and activities should be designed to meet the needs of the organization. They are not ends in themselves. Therefore the specific implications of this kind of framework for knowledge management will depend on the knowledge management needs of different kinds of activity and organization. Nevertheless, some general implications can be drawn out here.

This framework suggests above all that it is useful to distinguish 'knowledge' from 'knowledge representations'. We can use the term 'knowledge' meaning prior or tacit knowledge (in Alexander et.al.'s broader sense) to refer generally to the capacity for acting in the world that people 'bring' with them to any situation. It has been shaped by their previous activities, and will be developed and maintained by future activities. Activity by the organism 'triggers' an 'awakening' of parts of the total tacit knowledge 'reservoir' of an individual in ways that are situated with respect to that neurally based reservoir, to the immediate activity itself, and to the socio-cultural context within which it occurs. Activated tacit knowledge, now termed explicit knowledge, in the wider sense of this term, is thus situated, and localized.

Knowledge that is explicit in the wider sense has the potential to be expressed in words, and thus made 'explicit' in the narrower (knowledge management) sense. In other words, knowledge representations can be generated from explicit knowledge. But it should always be recognized that they were created in specific situations, and will bear the marks of their creation. Furthermore, that they will be 'consumed' in other specific situations. In so far as this 'consumption' process typically involves reading texts, and reading is also a constructive situated activity, not to be understood as simply a mechanistic process of 'knowledge transfer' [Gourlay 01] then the significance and impact of knowledge representations is also situationally determined.

Situated cognition highlights the historically and socially situated nature of any knowledge management process. Knowledge is seen as situated in communities of practice, in actual ongoing behaviour, and in neural form bound to both of these. It is integral to groups and their practices or activities and is therefore effectively inseparable from activity, and thus from the work of managing those activities, and the people who carry them out. It is not possible to manage knowledge directly because it is not a manageable substance but a capacity: it is human talent. Emphasis must therefore fall on managing the conditions under which that capacity is developed, maintained, and realized. On this basis Sierhuis and Clancey (1997) argued that «knowledge management becomes the management of the process of legitimate peripheral participation», a concept developed by Lave and Wenger (1991) to describe an apprenticeship-like form of learning through practice akin to informal and incidental

learning processes [Marsick and Watkins 90; Garrick 98a,b]. Situated cognition thus links knowledge management directly and inextricably with learning in organizational contexts, particularly learning through practice.

'Knowing in action' necessarily and irreducibly involves people at work, and the management of the 'process of legitimate peripheral participation' requires skills and knowledge derived from the behavioural sciences, such as psychology, sociology, anthropology, and history. In organizations with a typical division of labour among management specialisms, these skills are most likely to be found in human resource development, training, occupational psychology, and human resource management or personnel specialists. Since human activities are central so must the behavioural sciences be to the management of knowledge. 'Knowledge management' can only work, not as a directive process attempting to control a substance, 'knowledge', but as a facilitative process.

Knowledge representations also have to be managed as part of the overall portfolio of knowledge management activities and behavioural specialists will naturally have to work with people skilled in such fields, including computing and information scientists, and information systems analysts. This brings us to the more familiar set of activities - the acquisition, storage, accessing and so on of knowledge representations. It is here we find activities such as knowledge acquisition, and the development of ever more sophisticated methods of storing, disseminating, and accessing knowledge representations. It should always be born in mind, however, that knowledge representations only become knowledge in specific contexts, through human processes of selection and construction, using knowledge representations among other artefacts where they appear significant in the ongoing context of action.

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